

NON-PUBLIC?: N
ACCESSION #: 9303190144
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Salem Generating Station - Unit 1 PAGE: 1 OF 05

DOCKET NUMBER: 05000272

TITLE: Automatic Reactor Trip Due to Overtemperature Delta
Temperature Trip Signal (2/4 channels).
EVENT DATE: 02/16/93 LER #: 93-004-00 REPORT DATE: 03/11/93

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR
SECTION:
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: M. J. Pastva, Jr. - LER Coordinator TELEPHONE: (609) 339-2157

COMPONENT FAILURE DESCRIPTION:
CAUSE: X SYSTEM: JC COMPONENT: IS MANUFACTURER: W123
X SJ MO L200
X JC CAP H015
X SB RV F130
REPORTABLE NPRDS: Y
Y
Y
Y

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

At 1656 hours on 2/16/93, an automatic reactor Overtemperature Delta Temperature (OTDT) signal (2/4 channels) occurred due to tripping the OTDT Loop 11 Channel I bistables while the Loop 13 bistables were already tripped for ongoing Nuclear Instrumentation channel calibration. The unit was stabilized in Hot Standby. The root cause of this event is failure of the gain selector switch of Loop 11 OTDT input module QM-411B due to intermittent high contact resistance. This resulted in the Loop 11 OTDT setpoint decreasing to the point of actuating the loop bistables. A large spurious spike on the input to the Loop 11 OTDT setpoint

calculator drove it down which provided the necessary coincident logic to trip the loop bistables. Testing showed the QM-411B flux module output would trip high erratically with heat or minimal physical agitation. The 1QM411B module output gain selector switch, as well as the gain selector switches of the OTDT input modules for the balance of the unit's loops, were cleaned and exercised prior to the subsequent Reactor startup. Preventive Maintenance (PM) requirements for the subject modules (Westinghouse-Hagan) are being assessed to identify required changes to help ensure module service reliability.

END OF ABSTRACT

TEXT PAGE 2 OF 5

PLANT AND SYSTEM IDENTIFICATION:

Westinghouse - Pressurized Water Reactor

Energy Industry Identification System (EIIS) codes are identified in the text as {xx}

IDENTIFICATION OF OCCURRENCE:

Automatic Reactor Trip Due To Overtemperature Delta Temperature Trip Signal (2/4 channels)

Event Date: 2/16/93

Report Date: 3/11/93

This report was initiated by Incident Report No. 93-139.

CONDITIONS PRIOR TO OCCURRENCE:

Mode 1 Reactor Power 100% - Unit Load 1153 MWe

Scheduled surveillance calibration of the Nuclear Instrumentation System (NIS) power range 1N43 channel was in progress. The surveillance placed the Overtemperature Delta Temperature (OTDT) Loop 13 Channel III bistables in the TRIPPED position. This inserted a 1 out of 4 signal to the protection circuitry for OTDT, which uses 2 out of 4 relay logic for Reactor Protection System (RPS) actuation.

DESCRIPTION OF OCCURRENCE:

At 1656 hours, on February 16, 1993, an automatic reactor trip occurred due to an OTDT signal (2/4 channels). This resulted from tripping of the OTDT Loop 11 (Channel I) bistables while the Loop 13 bistables were already tripped for the ongoing 1N43 channel calibration. Plant response following the reactor trip was satisfactory except for excessive Reactor Coolant System (RCS) {AB} cooldown (as has occurred after other plant trips). In accordance with Emergency Operating Procedure EOP-TRIP-2, a Main Steamline Isolation (an ESF) was initiated stopping the cooldown. The Unit was stabilized in MODE 3 and at 1751 hours (same day) the Commission was notified of the Reactor Protection System {JC} automatic actuation, in accordance with the requirements of 10 CFR50.72 (b)(2)(ii).

TEXT PAGE 3 OF 5

APPARENT CAUSE OF OCCURRENCE:

The root cause of this event is equipment failure. The gain selector switch of OTDT input module QM-411B {JC} had intermittent high contact resistance. This switch is in the feedback loop of the operational amplifier. It is not required to be manipulated during normal calibration activities.

Due to the faulty gain selector switch, the setpoint for the Loop 11 OTDT had decreased to the point of actuating the loop bistables. This resulted in a large spurious spike (duration of approximately 45 minutes) on the input to the Loop 11 OTDT setpoint calculator driving it down. This provided the necessary coincident logic to trip the Loop 11 OTDT Channel I bistables. In addition, this spike affected the AFD circuitry, driving it high. Review of the AFD Target Band Recorder confirmed the high module output signal had occurred and sealed-in approximately three (3) minutes before the reactor trip. Bench testing showed the QM-411B flux module output would trip high erratically with heat or minimal physical agitation. In addition, this testing revealed spiking from Loop 11 OTDT setpoint calculation module 1TM412C {JC} due to a failed capacitor. However, the effect of these spikes from 1TM412C upon the OTDT circuitry could not be determined.

ANALYSIS OF OCCURRENCE:

This event did not affect the health and safety of the public and is reportable as an automatic RPS actuation in accordance with 10 CFR50.73(a)(2)(iv).

Reactor thermal power, coolant flow, coolant temperature, coolant pressure, and core power distribution are monitored (and applied) to ensure a departure from nucleate boiling (DNB) does not occur. The OTDT circuitry is part of the RPS used to mitigate the probability of DNB. The RCS coolant temperature, upper and lower core power flux, and RCS coolant pressure develop the OTDT setpoint for turbine runback or reactor trip.

One of the inputs to the OTDT trip setpoint calculation is the differential neutron flux between the top and bottom of the reactor core. Each reactor loop temperature setpoint has a corresponding power range neutron flux channel associated with its loop setpoint. During calibration of the 1N43 power range channel, channel III was removed from service by tripping the channel III OTDT bistable. As the result of the faulty gain selector switch on the QM-411B module, the setpoint for the OTDT on loop 11 had decreased to the point of actuating its protective bistable. Since normal difference between the setpoint and actual differential setpoint is 8 to 9 degrees F at 100% Reactor power, a high positive axial flux penalty thereby reduced the setpoint to the actual differential temperature value.

TEXT PAGE 4 OF 5

ANALYSIS OF OCCURRENCE: (cont'd)

The RPS functioned as designed and the heat sink was maintained during this event. Following the reactor trip, Main Steam Isolation was initiated due to excessive RCS cooldown. Reduction in T sub avg, requiring main steamline isolation, has been experienced during other reactor trips (e.g., Unit 1 LER 272/93-002-00 and Unit 2 LER 311/92-009-00). Engineering has investigated T sub avg reduction following trips and design modifications are being assessed.

Other problems noted following the reactor trip were:

11CN48 (11 Steam Generator Feed Pump bypass motor-operated valve) would not open from the Control Room console, due to failure of the motor-operator.

Loop 12 high steam flow Channel I actuated and did not clear, due to failed capacitors.

13MS10 (Steam Generator Atmospheric Relief Valve) would not operate in automatic control; however, the valve functioned satisfactorily in manual. This occurred due to a broken connector pin and failed servo amplifier.

CORRECTIVE ACTION:

The 1QM411B module output gain selector switch, Westinghouse Part No. 2111283, was cleaned and exercised. The gain selector switches of the OTDT input modules for the balance of the unit's loops were also cleaned and exercised prior to the subsequent Reactor startup. Preventive Maintenance (PM) requirements for the subject modules (Westinghouse-Hagan) are being assessed to identify required changes to help ensure module service reliability. In addition, the capacitors of module 1TM412C were replaced.

Capacitors in the Loop 12 high steam flow Channel I circuitry were replaced and the circuitry setpoint potentiometer was adjusted. Following satisfactory calibration and functional testing, the channel was returned to service.

The malfunctioning 11CN48 valve operator motor (Limitorque Corp. Model No. SMB-0) was replaced, tested satisfactorily, and the valve was returned to service.

A broken connector pin and failed servo amplifier, discovered in the 13MS10 valve E/P converter (Fishers Controls International Type 546), were replaced. The valve power supply (1PS-536) was calibrated and the valve returned to service.

TEXT PAGE 5 OF 5

CORRECTIVE ACTION: (cont'd)

Following completion of maintenance activities the unit was returned to service on February 23, 1993.

General Manager -
Salem Operations

MJPJ:pc

SORC Mtg. 93-022

ATTACHMENT 1 TO 9303190144 PAGE 1 OF 1

PSE&G

Public Service Electric and Gas Company P.O. Box 236 Hancocks Bridge,
New Jersey 08038

Salem Generating Station

March 11, 1993

U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Dear Sir:

SALEM GENERATING STATION
LICENSE NO. DPR-70
DOCKET NO. 50-272
UNIT NO. 1

LICENSEE EVENT REPORT 93-004-00

This Licensee Event Report is being submitted pursuant to the requirements of the Code of Federal Regulations 10CFR 50.73(a)(2)(iv). This report is required to be issued within thirty (30) days of event discovery.

Sincerely yours,

C. A Vondra
General Manager -
Salem Operations

MJPJ:pc

Distribution

The power is in your hands.

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